

Claims

1. A flexible tube to be disposed on an exhaust path for exhaust gas from an engine, the tube comprising an outer bellows that is an outer tube having a flexible part with bellows, and an inner bellows that is an inner tube having a flexible part with bellows, the inner tube being fixed to one open end part of the outer bellows, wherein a gap as a buffering space is provided between bottoms of the pleats of the outer bellows and tops of the pleats of the inner bellows.
2. The flexible tube according to Claim 1, wherein an overlapping space is provided where the inner bellows and an auxiliary pipe overlap each other, the inner bellows being fixed to an exhaust gas inlet of the outer bellows and extending toward an exhaust gas outlet thereof, the auxiliary pipe being fixed to the exhaust gas outlet of the outer bellows and extending toward the exhaust gas inlet; and an interference prevention member is held in the overlapping space.
3. The flexible tube according to Claim 2, wherein the interference prevention member is positioned utilizing a plurality of protrusions formed in the overlapping space for determining a longitudinal position thereof.
4. The flexible tube according to Claim 2, wherein the interference prevention member is made of mesh wire.
5. The flexible tube according to Claim 1, wherein the pleats of the inner bellows are smaller in depth and pitch than those of the outer bellows.
6. The flexible tube according to Claim 1, wherein an overlapping space is provided where the outer bellows and the inner bellows overlap each other,

the outer bellows being fixed to an outlet of the exhaust gas from the engine and the inner bellows extending toward an exhaust gas outlet; and an interference prevention member is held in the overlapping space.

5 7. The flexible tube according to Claim 6, wherein the interference prevention member held in the overlapping space has a nearly circular cross section.

10 8. The flexible tube according to Claim 1, wherein an overlapping space is provided where the inner bellows and an auxiliary pipe overlap each other, the inner bellows being fixed to the exhaust gas inlet of the outer bellows and extending toward the exhaust gas outlet, and the auxiliary pipe being fixed to the outlet of the outer bellows and extending toward the inlet, and the inner bellows and the auxiliary pipe in the overlapping space are disposed with a
15 gap therebetween that allows them to slidably move relative to each other.

20 9. The flexible tube according to Claim 1 or 2, wherein the overlapping space is rotatably and slidably configured to have an interference prevention member provided between an auxiliary pipe and an outer periphery of the other end part of the inner bellows, in such a manner that permits the interference prevention member to slide in axial directions; and wherein the interference prevention member comprises an outer spherical surface having a radius R with a center thereof aligned on an axis of the inner bellows, and the outer spherical surface overlaps and rotatably engages with an inner
25 spherical surface provided in the auxiliary pipe, the inner spherical surface having a radius R with a center thereof aligned on the axis of the inner bellows.

10. The flexible tube according to any one of Claims 2, 6 and 7, wherein the

inner bellows is separated into a plurality of pieces; on one end part of each piece, an outer spherical surface is provided so as to have a radius R with a center thereof aligned on an axis of the inner bellows; on the other end part of the adjacent inner bellows piece, an inner spherical surface is provided so as to have a radius R with a center thereof aligned on an axis of the inner bellows; and the outer spherical surface and inner spherical surface pivotally support each other to provide a spherical joint that can rotatably slide.

11. The flexible tube according to Claim 9, wherein the inner bellows is separated into a plurality of pieces; on one end part of each piece, an outer spherical surface is provided so as to have a radius R with a center thereof aligned on an axis of the inner bellows; on the other end part of the adjacent inner bellows piece, an inner spherical surface is provided so as to have a radius R with a center thereof aligned on an axis of the inner bellows; and the outer spherical surface and inner spherical surface pivotally support each other to provide a spherical joint that can rotatably slide.

12. The flexible tube according to Claim 10, wherein a ring-shaped interference prevention member is held on the outer periphery of the inner bellows; on the outer periphery of the interference prevention member, an outer spherical surface is provided so as to have a radius R with a center thereof aligned on an axis of the inner bellows; on the other end part of the adjacent inner bellows, an inner spherical surface is provided so as to have a radius R with a center thereof aligned on an axis of the inner bellows; and the outer spherical surface and inner spherical surface pivotally support each other to provide a spherical joint that can rotatably slide.

13. The flexible tube according to Claim 12, wherein a plurality of the spherical joints is provided on the inner bellows.

14. The flexible tube according to Claim 10, wherein a plurality of the spherical joints is provided on the inner bellows.

5 15. The flexible tube according to Claim 1, wherein a partition is disposed that splits the exhaust path in a direction from the exhaust gas inlet to the exhaust gas outlet.

10 16. The flexible tube according to Claim 15, wherein the partition has adhesive surfaces for attaching to the inner periphery of the inner bellows, and has a flexible part for allowing the partition to freely displace.

15 17. The flexible tube according to Claim 16, wherein the flexible part for allowing the partition to freely displace comprises bellows in the form of plate formed of steel plate having spring property.

20 18. The flexible tube according to Claim 16, wherein the flexible part for allowing the partition to freely displace includes a plurality of steel plates having spring property, one end part thereof being fixed to the partition on the inlet side in such a manner that the partition is clamped by the steel plates, and the other end parts thereof holding the partition on the outlet side in such a manner that the partition is clamped by the steel plates.